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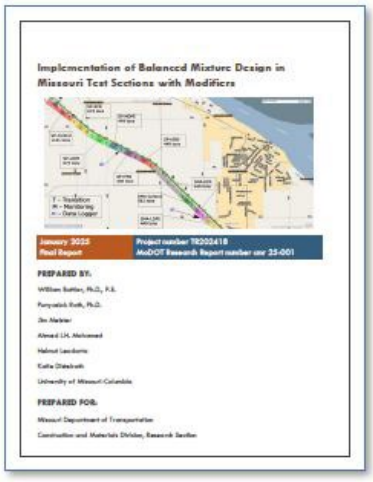
Research Summary

Implementation of BMD in Missouri Test Sections with Modifiers


Implementation of Balanced Mixture Design in Missouri Test Sections with Modifiers

In recent years, MoDOT has investigated the use of recycled polymers, such as ground tire rubber (GTR) and waste plastics (WP), in their Superpave and SMA mixtures. The increasing adoption of Balanced Mix Design (BMD) methodology has helped in the establishment of a framework wherein the contractors could facilitate material innovation through the adoption of these recycled polymers. To that end, MoDOT has supported the construction of several test sections to showcase the constructability and evaluate the field performance of recycled polymer modified asphalt mixtures design with BMD methodology. In 2021, MoDOT constructed four test sections on Route 740 (Stadium Blvd.) in Columbia, MO as a pilot implementation of the BMD method and acceptance criteria, and as a demonstration for the use of recycled polymers in asphalt mixtures.

In 2023, MoDOT identified an approximately six mile stretch of roadway along I-155 to lay out nine pavement mixtures. The mixtures included recycled (GTR and WP) and virgin (SBS and PPA) polymers incorporated into dense graded and SMA mixtures. The research team used the BMD requirements outlined in a MoDOT Joint Special Provision (JSP) specific to this project. The BMD requirements for the Superpave dense graded mixtures were broken into two tiers – normal and elevated. The normal BMD mixtures had a minimum CT-Index threshold of 45 and the elevated BMD mixtures had a minimum CT-Index threshold of 80. For SMA mixtures, the BMD requirements for the CT-Index was 160. The maximum rut depth requirement for all mixes was 12.5 mm at 15,000 passes. The research team tested Lab Mixed Lab Compacted (LMLC), Plant Mixed Plant Compacted (PMPC), and Plant Mixed Lab Compacted (PMLC) mixtures. A variety of tests were conducted on the mixtures to determine their performance; cracking tests included IDEAL-CT and DC(T), rutting tests included HWTT and IDEAL-RT, and moisture damage tests included TSR and the SIP parameter derived from the HWTT.

The IDEAL-CT results showed good cracking resistance for all the mixtures. All PMPC mixtures except two showed an increase in CT-Index compared to LMLC mixtures. The two exceptions were measured to have a statistically similar CT-Index to their LMLC counterparts. Regarding CT-Index, the recycled polymer modified mixtures were on par with or better than the virgin polymer mixtures. Similar conclusions were drawn from the DC(T) fracture energy results of the PMLC mixtures. In terms of HWTT rutting, all the mixtures were exceptional. The PMPC mixtures had higher rutting compared to the LMLC mixtures and the PMLC mixtures showed the least rutting, indicating different aging levels in LMLC, PMPC, and PMLC mixtures. Once again, the

recycled polymer mixtures performed similarly or better than the virgin polymer mixtures. Only the PMLC Superpave mixtures were evaluated for moisture damage. The SIP parameter showed that none of the mixtures were prone to stripping. TSR results highlighted one mixture that was a borderline failure (TSR = 79.1), but all the other mixtures had high TSR, above 90. Overall, the Superpave mixtures were resistant to moisture damage.

The research team will continue to evaluate the long-term performance of these sections through periodical field visits. The aim of these visits is to correlate field observations with laboratory results. This will help finetune the BMD thresholds and improve mixture designs. Furthermore, the long-term performance of the recycled polymer sections will inform the development of specifications to facilitate the adoption of recycled polymers in mixtures in lieu of virgin polymers. While an asphalt specification exists for the use of ground tire rubber via the dry process in Missouri, a similar specification has yet to be developed to guide the use of recycled waste plastics in MoDOT asphalt mixtures. It is recommended that the results presented herein, along with those gathered in the earlier demonstration project conducted on Stadium Blvd. in Columbia, MO, be used address this technological gap, e.g., to create a specification for the proper use of recycled waste plastics in MoDOT asphalt mixtures.

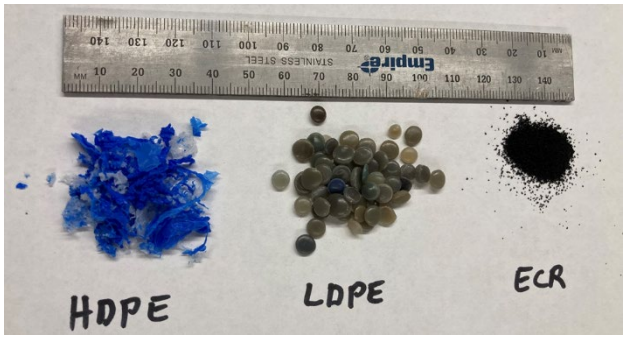


Figure 1: Image showing the different recycled polymers used in this study

Project Information

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